

Homework 0 - Alohomora

CMSC 733

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Choice of phase: Phase 1 Shake my boundary

Abstract—This homework focuses on developing a simplified version of pb-lite boundary detection algorithm, which finds boundaries by examining brightness, color, and texture information across multiple scales (different sizes of objects/image) by using filter banks. The output of the algorithm will be a per-pixel probability of boundary. The simplified boundary detector significantly outperforms the well regarded Canny and Sobel edge detectors.

I. INTRODUCTION

The pb-lite algorithm gives the per-pixel probability of the boundary in an image. The entire algorithm is divided into 4 steps which are as follows:-

1. Filter bank generation.
2. Texton, Brightness and Color Map generation
3. Texture, Brightness and Color gradient generation
4. Combining information from features with sobel and canny baselines.

The above mentioned steps are explained in detail in the following subsections.

A. Filter bank generation

The first step of the pb-lite boundary detection algorithm is to filter the image with different filter banks. The 3 different types of filter banks used in this homework are Oriented DoG filters, Leung-Malik Filters, and Gabor Filters.

1) *Oriented DoG filters*: Oriented DoG filters can be created by convolving a simple Sobel filter and a Gaussian kernel and then rotating the result. The oriented DoG filters for 2 scales() and 16 orientations(from 0 to 360 degrees) are shown in Figure.

2) *Leung-Malik filters*: The Leung-Malik filters or LM filters are a set of multi scale, multi orientation filter bank with 48 filters. It consists of first and second order derivatives of Gaussians at 6 orientations and 3 scales making a total of 36; 8 Laplacian of Gaussian (LOG) filters; and 4 Gaussians. In this filter bank we implement two versions of LM filters. In LM Small (LMS), the filters occur at basic scales. The first and second derivative filters occur at the first three scales with an elongation factor of 3. The Gaussians occur at the four basic scales while the 8 LOG filters occur at sigma and 3-sigma. For LM Large (LML), the filters occur at the basic scales. Both LMS and LML are shown in Figure and Figure respectively.

3) *Gabor filters*: A gabor filter is a gaussian kernel function modulated by a sinusoidal plane wave of a particular frequency and orientation. When a Gabor filter is applied to an image, it gives the highest response at edges and at points where texture changes. It has the following parameters: - lambda-Wavelength of the sinusoidal component, theta-The orientation of the normal to the parallel stripes of Gabor function, psi-The phase offset of the sinusoidal function, sigma-The sigma/standard deviation of the Gaussian envelope. The effect of these parameters on the filter is explained in []. The gabor filters for 5 scales and 8 orientations are shown in the figure.

B. Texton, Brightness and Color map generation

II. CONCLUSION

The conclusion goes here.

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REFERENCES

- [1] H. Kopka and P. W. Daly, *A Guide to L^AT_EX*, 3rd ed. Harlow, England: Addison-Wesley, 1999.